

04/14/2004
PWHRWR-03
Page 1



Materials and Processes for the New Millennium

Materials and Process Engineering
Florida Technical Services
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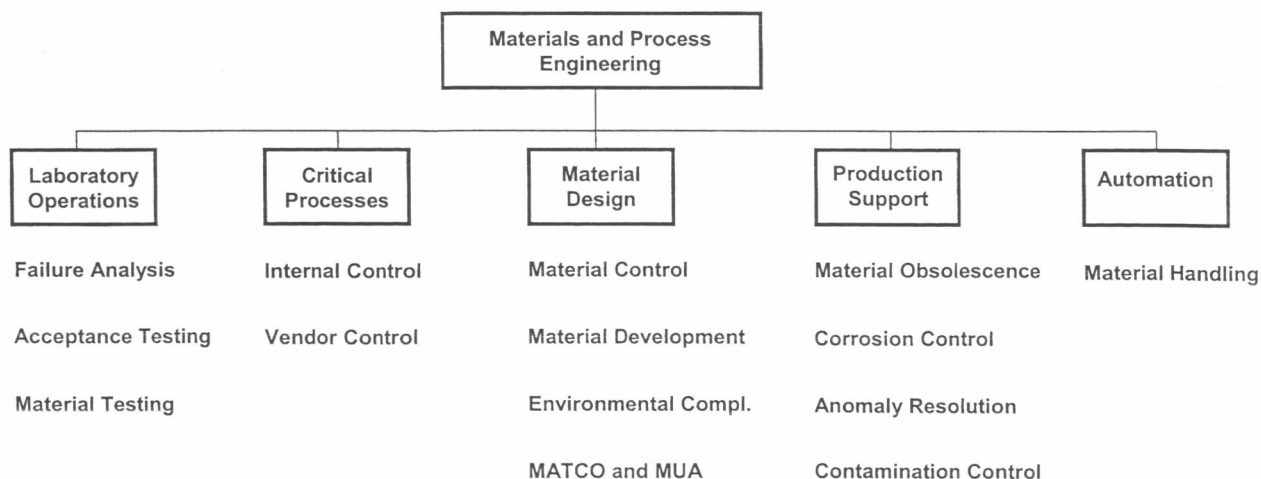
The Last Decade – Environmental Compliance

- *The single greatest threat to material availability over the last decade has been Compliance to New Environmental Regulations*
- *Federal Regulations*
 - *Clean Air Acts Amendments – 1990*
 - *Titles I, III and VI*
 - *NASA Interim Policy – 1995 end date*
 - *Montreal Protocol – 2000 and 2005 end dates*
 - *Industrial Toxics Project – HAP emissions by 1995*
 - *Florida DER – VOC limits by 1995 (CA)*
 - *OSHA Health Related Regulations*
 - *Carcinogens*
 - *Mutagens*
 - *Toxins*
- *Material availability complicated by local and state regulations and their own compliance schedules*

04/14/2004
PWHRWR-03
Page 3



Responsibilities and Capabilities



04/14/2004
PWHRWR-03
Page 2



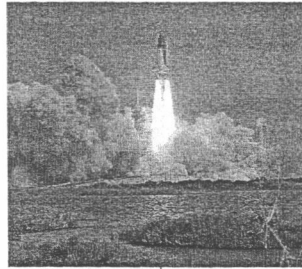
The Last Decade – Thermal Protection System (TPS) Materials

Convergent Spray Technology – Marshall Convergent Coating – MCC-1 Patented Process

Only solventless sprayable TPS

First On-Demand TPS delivery system

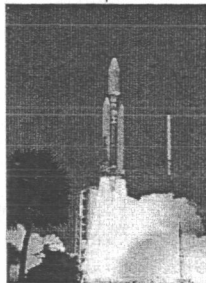
Utilizes long-proven materials



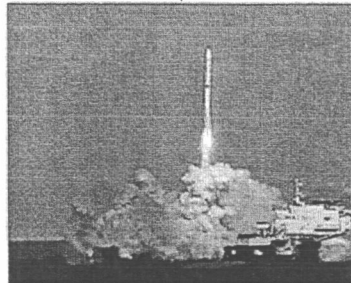
Robotically Applied

Features automated material handling

Recognized industry-wide



Titan IV



Sea Launch



Delta IV

04/14/2004
PWHRWR-03
Page 5



The Last Decade – Major SRB Environmental Initiatives

- Replacement of Booster Close-out material with a trowellable ablator – Eliminated human mutagen
- Replaced lead based paint system with a water based paint system – Eliminated lead, Hazardous Air Pollutant (HAP) and VOC content
- Qualified Tric-Free Paint – Eliminated 1,1,1 - Trichloroethane
- Qualified and Implemented environmentally friendly cleaners – Eliminated hazardous solvent
- Qualified foam blowing agent replacement
- Replaced MSA-2 with Marshall Convergent Coating (MCC-1) – Eliminated methylene chloride, perchloroethylene and hazardous waste
- Replaced insulation on USAF Titan IV – Eliminated Freon agent
- Replaced hazardous metal pretreatment process with non hazardous pretreatment – Eliminated large volume hazardous waste

04/14/2004
PWHRWR-03
Page 4



The Next Decade – Managing Material Change and Obsolescence

- Over the past decade, managing compliance with environmental regulations and supply chain viability has been the greatest challenge

1999 Rustoleum to Briner product (Carboline product as alternate)

2000 Carboline buys Briner, eliminates Briner product

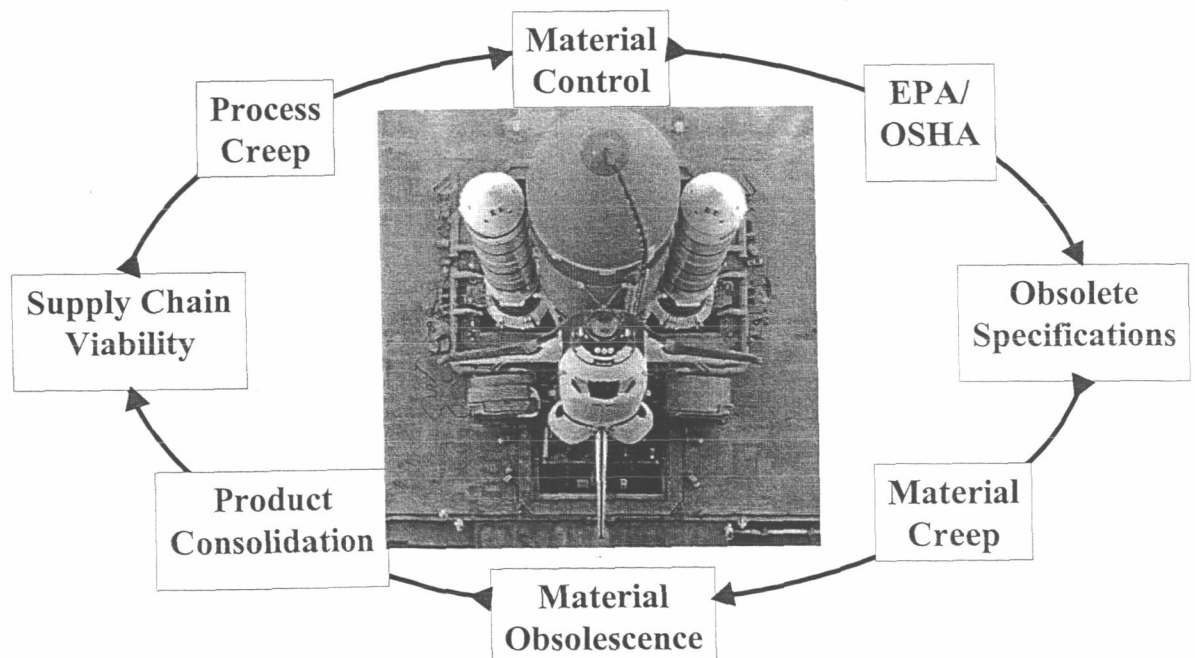
2000 Briner product to Rustoleum

2001 Carboline reformulates the alternate material

04/14/2004
PWHRWR-03
Page 7



The Next Decade – Managing Material Change and Obsolescence

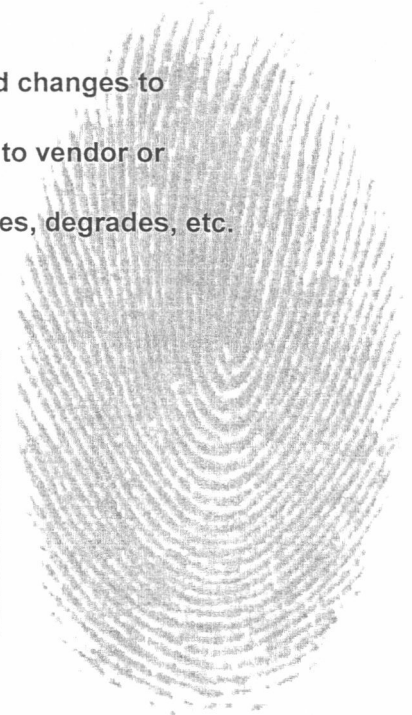
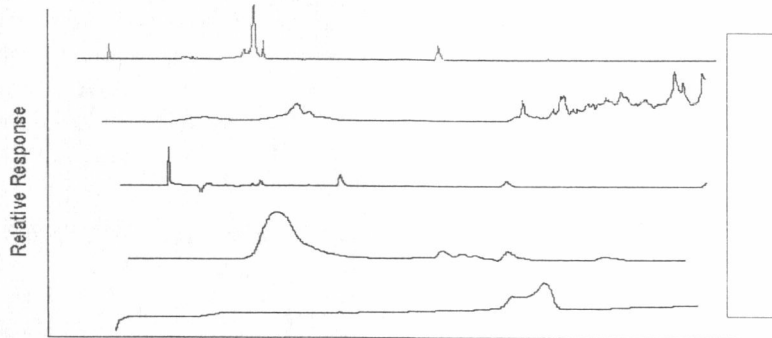


04/14/2004
PWHRWR-03
Page 6



The Next Decade – *Material Fingerprinting*

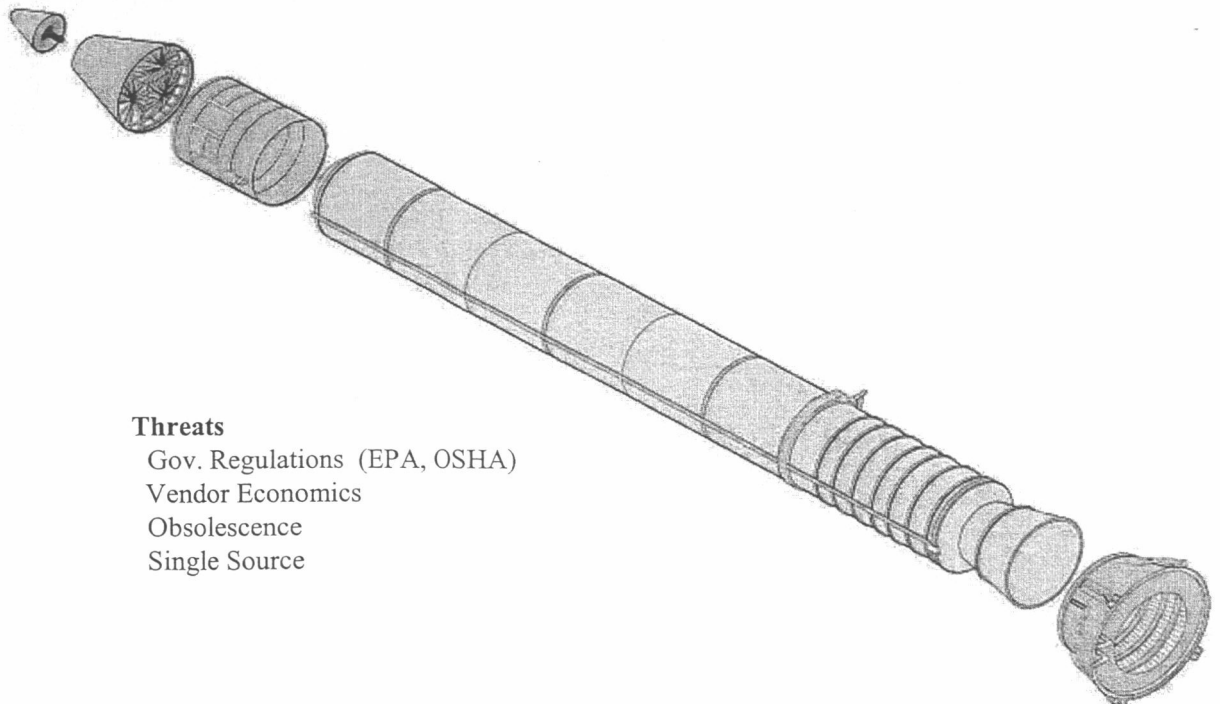
- Objectives of Chemical Fingerprinting
 - Enhanced understanding of material composition
 - Reduced probability of unexpected and unrecognized changes to critical materials
 - Enhanced ability to detect changes in a material due to vendor or subtler supplier changes
 - Improved understanding of how a material works, ages, degrades, etc.



04/14/2004
PWHRWR-03
Page 9



The Next Decade – *Managing Material Change and Obsolescence*



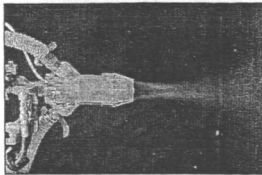
Threats

Gov. Regulations (EPA, OSHA)
Vendor Economics
Obsolescence
Single Source

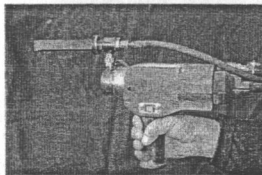
04/14/2004
PWHRWR-03
Page 8



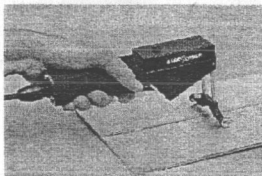
The Next Decade – New Materials and Technology



Thermal Management Coating



Cold Spray



Laser-based Corrosion Mapping

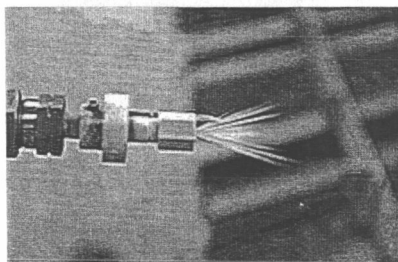


Corrosion Inhibiting Paint Additives

04/14/2004
PWHRWR-03
Page 11

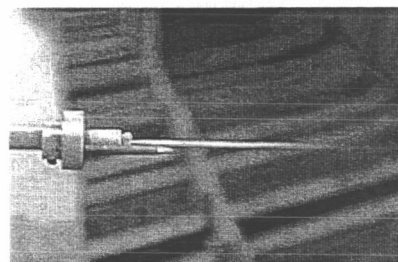


The Next Decade – De-Coating Technology



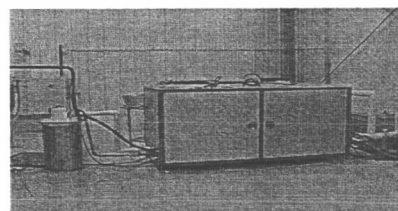
Water Based De-Coating System

- Existing De-Coating operation uses high pressure water
- Results in corrosive environment for metallic hardware
- Waste stream significantly increased by water content
- Disposal costs increased proportionally



High Pressure LN2 De-Coating System

- Patented Process
- Creates No Secondary Waste Stream
- Hazardous Waste Reduction
- Commercially Available Components
- Insulated Components Protect From Low Temperature Contact

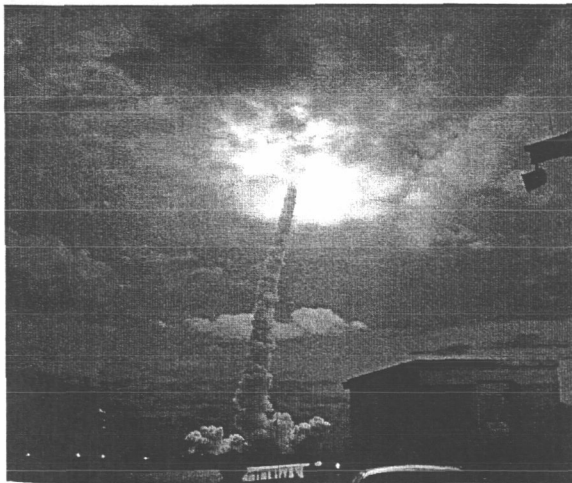


04/14/2004
PWHRWR-03
Page 10



The Next Decade – *Space Shuttle to CEV*

- The challenge is not identifying “New” materials and technology – the challenge is managing our existing materials such that a viable “material base” exists for the next generation vehicle



- The next generation vehicle will no doubt use the same families of materials, in largely the same environments
- Control and management of our existing materials and processes offers the only cost and schedule effective means by which to address the requirements of next generation vehicles